



“Go Figure!” **A Celebration of Math**

“We improve ourselves by victories over ourselves.
There must be contests, and you must win.” – Edward Gibbon

Program Description

The *Go Figure!* Mathematical Challenge is co-sponsored by Los Alamos National Laboratory and Sandia National Laboratories and funded by the US Department of Energy Defense Programs. The Challenge is dedicated to strengthening the mathematical capabilities of our nation’s youth by identifying, recognizing and rewarding those students talented in mathematical thinking. Other goals include (1) engaging parents and the community in recognizing and supporting talented students, (2) engaging teachers in *Go Figure!* with the intent of stimulating them to be better math teachers, (3) engaging talented students and involving them with the Laboratories in summer internships or in other capacities so as to aid in their development and make their successful recruitment as professional staff members more likely, and (4) increasing the diversity of the Laboratories’ pipelines by targeting students from underrepresented populations. It is hoped that by participating in the competition students will be reminded that mathematics and algebra are the building blocks for all the scientific disciplines and that without that foundation their career opportunities will be severely limited.

Go Figure! targets students from grades 7–12 in northern New Mexico and provides them the opportunity to participate in problem solving and enriching mathematical experiences. It is intended for everyone from the average student who enjoys mathematics to the very best student who excels in mathematics. The various recruitment strategies include site visits to the schools by the Laboratory program coordinator and Laboratory technical staff members, local radio and TV public service announcements, news releases in local newspapers and the Laboratory daily newsbulletin, and the *Go Figure!* website <http://set.lanl.gov/programs/gofigure>.

The contest is structured such that participants are offered 13 problems and two and one-half hours of time to solve them. Problems are

selected that require for their solutions a minimal amount of knowledge and a great deal of creativity, originality, and analytical thinking. When the contest is graded, credit is given for supporting work, thus rewarding originality and creativity. Pre-registration is not offered, and there is no restriction placed on the number of participants from each school, for doing so would put schools in a position of deciding who will represent them, which would in most cases mean choosing “A” students, and not best talents, which is what the contest seeks.

Performance Objective and Milestones

The performance objectives of *Go Figure!* focus on enhancing the supply of well-qualified mathematicians, especially at the Laboratory, by

providing tools and resources to prepare students for induction into the workforce pipeline. This objective is met through (1) tracking educational and career aspirations of program participants via a database and ongoing communications; (2) inviting Laboratory technical staff members and technicians to attend workshop activities, thus promoting positive relationships and exposing the students and parents to a larger network of scientific knowledge; (3) developing a program summer internship component; and (4) recruiting the most promising students into the Laboratory pipeline.

The program purpose is to create a renewed interest in mathematics in northern New Mexico by encouraging student confidence in mathematics and to foster connections between content knowledge of math and its applications in the area of national security. Many students first develop an interest in mathematics through problem-solving activities such as *Go Figure!* Through the development and promotion of such programs, an improvement in the attitudes of teachers, students, and their parents toward the ability to understand and apply mathematics is expected to take place. To that end, FY01 saw *Go Figure!* expand its official contest locations to include Cuba Middle School and Española Middle School.

In addition to expanding this past year to include a broader geographical area, the program strengthened its involvement with the Northern New Mexico Council for Excellence in Education's (NNMCEE), MSA as a recruitment avenue for promoting the contest. The association with the MSA is, by all accounts, a positive influence on *Go Figure!*

Throughout the *Go Figure!* experience over the past three years, students and teachers have developed a Web-based communications network with the intent of creating a strong educational support network among the participants and their surrounding higher-learning institutes, such as the Laboratory and San Juan College.

Students are encouraged to take practice tests and view previous years' exams on the *Go Figure!* website, in order to better prepare for the contest.

Highlights of this Year's Accomplishments

This past year also saw an increased collaboration between the sponsoring Laboratories—Los Alamos National Laboratory and Sandia National Laboratories. The Los Alamos staff wishes to thank their colleagues at Sandia for helping to identify appropriate technical staff members to serve as proctors and graders. This collaboration resulted in Dr. Madhav Marathe, D-2, the Basic and Applied Simulation Science Group at the Laboratory, serving as a proctor for the October 27, 2001 Challenge.

The successful Four Corners *Go Figure!* Mathematical Challenge was held on October 27, 2001, with 68 participants spanning the seventh through the twelfth grades. The contest was held at San Juan Community College in Farmington, New Mexico, Los Alamos Middle School, Española Middle School, and Cuba Middle School. Los Alamos National Laboratory sponsored all four sites. Contest participants accepted the challenge of a two-and-half hour test on problems that ranged from easy to very difficult. Most enjoyed the contest and found it mentally stimulating and challenging. A banquet honoring the winners of the contest was held on November 15, 2001, in Farmington with the highlight of the evening being a presentation by Vernon Willie, a professor at San Juan Community College. The banquet was well attended by students, teachers, and parents.

The following books were awarded as prizes to the winning students from each grade level for their achievements in the 2001 *Go Figure!* Mathematics Challenge:

“Enjoyment of Mathematics: Selections from Mathematics for the Amateur,” by Hans

Rademacher and Otto Teoplitz, ISBN 0-691-02351-4.

“What is Mathematics? An Elementary Approach to Ideas and Methods,” 2nd Edition, by Richard Courant et al., ISBN 0-19-510519-2.

“Mathematical Discovery, Combined Volume,” by George Polya, ISBN 0-471-08975-3.

“How to Solve It,” by George Polya, ISBN 0-691-02356-5.

“Number Theory and Its History,” by Oystein Ore, ISBN 0-486-656209-9.

“The Wohascum Country Problem Book,” by George Gilbert et al., ISBN 0-88385-316-7.

As in previous years, Dr. Abraham Hillman was an invaluable contributor to the development, implementation, and success of the FY01 *Go Figure!* Challenge. It is important to capture the essence of Dr. Hillman’s pedagogy in the planning, grading, and recruiting in order to improve the implementation of this effort as it grows in popularity.

On August 14, 2001, 38 winning students from the November 4, 2000, *Go Figure!* Challenge were invited to Los Alamos to participate in a *Go Figure!* Enrichment Day. The day began with tours of the Los Alamos Historical Society Museum and the Bradbury Science Museum where the students furthered their knowledge of the history of the Laboratory and examined project displays that convene some of the mathematical research conducted at the Laboratory. Following the tours, they lunched with representatives of the Laboratory’s Educational Program Office (EPO) and Dr. Madhav Marathe and other invited mathematicians from the Laboratory. Lunch was followed by a roundtable session where Dr. Marathe led an interactive discussion

on theoretical mathematics at the Laboratory and challenged the students to accept his invitation to serve an internship under his mentorship next summer. The day concluded with the students attending two mini-sessions taught by EPO staff. The sessions instructed them about how to build an educational Website, informed them about the various student opportunities at the Laboratory, and taught them how to recruit students at their schools for the next *Go Figure!* Challenge to be held in October 2002.

Future recruitment for *Go Figure!* will be enhanced by a video that Vernon Willie, mathematics professor at San Juan Community College in Farmington, is planning to produce in FY02 in conjunction with students at a school in the Four Corners area.

Comments from Participants

“I really enjoyed the LANL Go Figure! Day. Madave Marathe was an excellent speaker and for the first time I understand why math is so important!”

“The tours at LANL were great. I enjoyed the Bradbury Science museum and having lunch with other students and scientists at the Los Alamos National Laboratory. I felt important.”

“I have been involved in a lot of math competitions but this contest is great, and I got to come to the Los Alamos National Laboratory for a day.”

“Professor Vernon Willie’s talk at the banquet was really good and showed us how math is used in everyday things like the nautilus shell.”

“The books we got for awards for the Go Figure! contest were good books on math. I shared them with my sisters and brother at home, my math class at school, and students in my math club.”

Comments from Parents and Teachers

“After hearing from Madave Marathe, technical staff member at LANL, we went back to Farmington and demanded a more rigorous math curriculum for our students so they can better succeed in college and in life.”

“Mr. Vigil came into our math classes and did a great job recruiting for the upcoming Go Figure! Math Contest. The students enjoyed his hands-on presentation style.”

“I have worked with Go Figure! for three years and the program gets better and better. Thank you DOE/DP and Los Alamos National Laboratory.”

“Thank you so much for the nice banquet honoring my students. The students here are not my best students but are solid students, who with this recognition, could become top-notch math students and could go on to college and excel in mathematics.”

“I am so proud of mi hita. We love her very much and want the best for her. I want her to do better than I did in school. Thanks for your support of our children.”

“The food was good, and the talk by Vernon Willie was very interesting and cultural. I would like to meet this Professor Abe Hillman and shake his hand.”